1 Reply to reviewer #1

We are grateful for the helpful comments on our paper draft. Especially, the additional references (DOIs) improved our paper. Our point-by-point reply is in italic.

Reviewer 1:

Review of *amt*2017463, Dorrestijn et al.

GENERAL

The entire abstract will need to be rewritten in view of the results contained in the DOIs listed at the end of this review. It reflects omissions and mistaken assumptions listed in the detailed commentary that follows. The scaling of variance has to recognise that the variance of atmospheric variables obtained by observations acquired by adequate measurement techniques does not converge. That is one of several relevant results obtained by the finding that atmospheric variables have non-Gaussian probability distributions, with fat-tailed power laws best represented by Lévy statistics. The zoo of scaling behaviours displayed in this manuscript arises from this basic fact and its consequences. These facts have to be at least recognised as being in existence rather than simply ignored as in the present manuscript.

We choose to not rewrite the abstract, since it represents the findings of our research. The correlation between β_L and the temperature slope along the track is -0.76, which is sufficiently strong to justify our assertions about the slopes. We remove the assertion that geostrophic turbulence is likely the cause of the k^{-3} scaling.

About the convergence we will add to the manuscript (page 12, line 6) that: "another explanation for the large variety of exponents is the turbulent structure of the temperature and water vapor fields with long-tailed non-Gaussian distributions (Tuck 2010) that could inhibit correct estimation of the variance scaling exponents."

DETAILED COMMENTARY

Page 1, Lines 16-18: Energy is deposited in the atmosphere by the absorption of photons by molecules, that is to say it has no alternative but to propagate upscale. This is argued at length in some of the references supplied as DOIs.

We rewrote part of the introduction such that it is not necessary to include this comment

Lines 18 et seq: See the last, 8th, DOI for a refutation of these arguments. They are profoundly mistaken.
We will omit this sentence to avoid any confusion.

Page 2, Lines 3-14: Inspection of the DOIs supplied will show a view differing substantially from that in these references. The Lindborg papers especially rest on bad assumptions. The Lovejoy & Schertzer book also has a lot on scaling in models, an advance on lines 15-28.

We mentioned the Lindborg paper because it reprints the Nastrom and Gage figure; We will add (page 2, line 13) the Lovejoy and Schertzer book to the list of numerical modeling and scaling paragraph.

Section 3: KT09 in my opinion deploys flawed analytical methods. If the authors insist on using it, it must be justified in the light of the conclusions reached in the DOIs below. That includes the results on how easy it is to find false scale breaks, especially if less than three decades of good quality observations are present. They cannot be simply ignored.

That KT09 works has been confirmed by Vogelzang 2015.
We add (page 12, line 21): "Lovejoy et al. (2009) and Pinel et al. (2012) showed that scale-breaks detected by aircrafts can be a result of anisotropy in the atmosphere; the transition to the -2.4 slope can indicate that at the larger scales the vertical scaling is detected instead of the horizontal. So, it can be the case that our scale-breaks are also a result of anisotropy."

Sections 4 and 5: At the very least these will have to be rewritten to accommodate the existence of alternative views and results conatined in the DOIs and books listed below. For example, models contain assumptions about variances and covariances being random that are at odds with observed reality; that is one of many problems.

We will add that there are alternative views and add the references in the discussion section.

For example:

In the discussion section we add (page 11, line 12): In Pinel et al. 2012, scale-breaks are found in the range 100 - 500 km with horizontal exponents that transition from -5/3 to -2.4. In the vertical direction they find the exponent -2.4, so they suggest that gently sloping isobaric aircraft trajectories cause the transition to -2.4.